

Listing of Claims:

1. (Previously presented) A machine for slitting a metal sheet comprising:
 - a frame;
 - an upper drive shaft assembly mounted for rotation in the frame;
 - a lower drive shaft assembly mounted for rotation in the frame;
 - each of the upper and lower drive shaft assemblies comprising a plurality of drive shaft sections each being coupled through a coupling mechanism to an adjacent drive shaft section for rotation in the frame, each coupling mechanism being mounted to rotate with the plurality of coupled drive shaft sections;
 - a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;
 - inner and outer pairs of upper rail supports;
 - inner and outer pairs of lower rail supports;
 - a plurality of knife holder assemblies supported by the frame in pairs for movement along the drive shaft assemblies such that a first knife holder assembly is supported by one pair of the inner and outer pairs of upper rail supports for movement along the upper drive shaft assembly and being nestable with an adjacent first knife holder assembly and a second knife holder assembly is supported by one pair of the inner and outer pairs of lower rail supports for movement along the lower drive shaft assembly and being nestable with an adjacent second knife holder assembly;

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a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies ;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

a knife holder position adjustment system operably coupled to each of the knife holder assemblies for movement of the knife holder assembly along the respective drive shaft assembly; and

a programmable controller operably coupled to the knife holder position adjustment system to position the knife holder assemblies along the respective drive shaft assemblies.

2. (Original) The machine of claim 1 wherein the frame further comprises:
an upper frame in which the upper drive shaft assembly is rotatably mounted; and
a lower frame coupled to the upper frame and in which the lower drive shaft assembly is rotatably mounted.

3. (Original) The machine of claim 1 wherein the knife holder position adjustment system further comprises:
an upper threaded shaft mounted in the frame; and

a lower threaded shaft mounted in the frame;

wherein each of the knife holder assemblies are threadably coupled to one of the threaded shafts such that rotation of at least a portion of each knife holder assembly relative to the associated threaded shaft moves the knife holder assembly along the associated drive shaft assembly.

4. (Original) The machine of claim 3 wherein the knife holder position adjustment system further comprises:

a plurality of positioning motors each being mounted to one of the knife holder assemblies and operably coupled to the programmable controller; and

a plurality of ball nuts each being mounted to one of the knife holder assemblies, threadably coupled to one of the threaded shafts and operatively coupled to the associated positioning motor;

wherein actuation of each positioning motor by the programmable controller rotates the associated ball nut for movement of the associated knife holder assembly along the associated drive shaft assembly.

5. (Original) The machine of claim 1 wherein a position of each of the knife holder assemblies is adjustable by the knife holder position adjustment system independent from each of the other knife holder assemblies.

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6. (Previously presented) A machine for slitting a metal sheet comprising:

an upper frame;

a lower frame coupled to the upper frame;

an upper drive shaft assembly mounted for rotation in the upper frame, said upper drive shaft assembly comprising a plurality of upper drive shaft sections each being coupled through an upper coupling mechanism to an adjacent upper drive shaft section for rotation in the frame, each upper coupling mechanism being mounted to rotate with the plurality of coupled upper drive shaft sections;

a lower drive shaft assembly mounted for rotation in the lower frame, said lower drive shaft assembly comprising a plurality of lower drive shaft sections each being coupled through a lower coupling mechanism to an adjacent lower drive shaft section for rotation in the frame, each lower coupling mechanism being mounted to rotate with the plurality of coupled lower drive shaft sections;

a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;

inner and outer pairs of upper rail supports;

inner and outer pairs of lower rail supports;

a plurality of knife holder assemblies supported by the upper and lower frames in pairs for movement along the drive shaft assemblies such that a first knife holder assembly is supported by one pair of the inner and outer pairs of upper rail supports for movement along the

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upper drive shaft assembly and being nestable with an adjacent first knife holder assembly and a second knife holder assembly is supported by one pair of the inner and outer pairs of lower rail supports for movement along the lower drive shaft assembly and being nestable with an adjacent second knife holder assembly;

a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

a plurality of positioning motors each being mounted to one of the knife holder assemblies;

an upper threaded shaft mounted in the upper frame;

a lower threaded shaft mounted in the lower frame;

a plurality of ball nuts each being mounted to one of the knife holder assemblies, threadably coupled to one of the threaded shafts and operatively coupled to the associated positioning motor;

wherein rotation of at least a portion of each ball nut relative to the associated threaded shaft moves the knife holder assembly along the associated drive shaft assembly;

a programmable controller operably coupled to each of the positioning motors to position the knife holder assemblies along the respective drive shaft assemblies;

wherein actuation of each positioning motor by the programmable controller rotates the associated ball nut for movement of the associated knife holder assembly along the associated drive shaft assembly; and

wherein a position of each of the knife holder assemblies is adjustable independent from each of the other knife holder assemblies.

7. (Previously presented) A machine for slitting a metal sheet comprising:
a frame;

an upper drive shaft assembly mounted for rotation in the frame;

a lower drive shaft assembly mounted for rotation in the frame;

each of the drive shaft assemblies comprising a plurality of drive shaft sections each being coupled through a coupling mechanism to an adjacent drive shaft section for rotation in the frame, each coupling mechanism being mounted to rotate with the plurality of coupled drive shaft sections;

a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;

a plurality of knife holder assemblies supported by the frame in pairs for movement along the drive shaft assemblies such that a first knife holder assembly is supported for movement along the upper drive shaft assembly and a second knife holder assembly is supported for movement along the lower drive shaft assembly; and

a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

wherein the adjacent drive shaft sections of each drive shaft assembly are adapted to be selectively repositioned relative to one another for servicing the machine.

8. (Previously presented) The machine of claim 7 wherein:
the coupling mechanism releasably couples the adjacent drive shaft sections together.

9. (Original) The machine of claim 8 wherein the coupling mechanism is a coupling, each drive shaft section further comprising:
a spindle projecting axially from the drive shaft section, the coupling releasably connecting the spindles on adjacent drive shaft sections.

10. (Original) The machine of claim 7 further comprising:
a drive shaft uncoupling mechanism for a user to selectively uncouple the adjacent drive shaft sections.

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11. (Original) The machine of claim 10 wherein the drive shaft uncoupling mechanism further comprises:

a screw operably coupled to at least one of the drive shaft sections;

whereupon rotation of the screw axially withdraws the drive shaft section from the adjacent drive shaft section.

12. (Original) The machine of claim 7 wherein the adjacent drive shaft sections are uncoupled from one another for servicing of one of the knife holder assemblies positioned proximate a juncture of the adjacent drive shaft sections.

13. (Previously presented) A machine for slitting a metal sheet comprising:

a frame;

an upper drive shaft assembly mounted for rotation in the frame;

a lower drive shaft assembly mounted for rotation in the frame;

each of the drive shaft assemblies comprising a plurality of drive shaft sections each being releasably coupled to an adjacent drive shaft section for rotation in the frame ;

a spindle projecting axially from each of the drive shaft sections;

a coupling releasably connecting the spindles on adjacent drive shaft sections together each coupling being mounted to rotate with the drive shaft sections;

a drive motor operably coupled to the upper and the lower drive shaft assemblies

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for rotation of the drive shaft assemblies;

a plurality of knife holder assemblies supported by the frame in pairs for movement along the drive shaft assemblies such that a first knife holder assembly is supported for movement along the upper drive shaft assembly and a second knife holder assembly is supported for movement along the lower drive shaft assembly;

a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

wherein the adjacent drive shaft sections of each drive shaft assembly are adapted to be selectively uncoupled from one another for servicing of one of the knife holder assemblies positioned proximate a juncture of the adjacent drive shaft sections; and

a screw operably coupled to at least one of the drive shaft sections;

whereupon rotation of the screw axially withdraws the drive shaft section from the adjacent drive shaft section.

14. (Previously presented) A machine for slitting a metal sheet comprising:
a frame;
an upper drive shaft assembly mounted for rotation in the frame;

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a lower drive shaft assembly mounted for rotation in the frame;

each of the drive shaft assemblies comprising a plurality of drive shaft sections each being releasably coupled to an adjacent drive shaft section for rotation in the frame;

a coupling mounted to releasably couple the adjacent drive shafts together and rotate with the drive shaft sections;

wherein the adjacent drive shaft sections of each drive shaft assembly are adapted to be selectively uncoupled from one another for servicing the machine;

a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;

a plurality of knife holder assemblies supported by the frame in pairs for movement along the drive shaft assemblies such that a first knife holder assembly is supported for movement along the upper drive shaft assembly and a second knife holder assembly is supported for movement along the lower drive shaft assembly;

a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

a knife holder position adjustment system operably coupled to each of the knife holder assemblies for movement of the knife holder assembly along the respective drive shaft

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assembly; and

a programmable controller operably coupled to the knife holder position adjustment system to position the knife holder assemblies along the respective drive shaft assemblies.

15. (Previously presented) A machine for slitting a metal sheet comprising:
 - an upper frame;
 - a lower frame coupled to the upper frame;
 - an upper drive shaft assembly mounted for rotation in the upper frame, said upper drive shaft assembly comprising a plurality of upper drive shaft sections each being coupled through an upper coupling mechanism to an adjacent upper drive shaft section for rotation in the frame, each upper coupling mechanism being mounted to rotate with the plurality of coupled upper drive shaft sections;
 - a lower drive shaft assembly mounted for rotation in the lower frame, said lower drive shaft assembly comprising a plurality of lower drive shaft sections each being coupled through a lower coupling mechanism to an adjacent lower drive shaft section for rotation in the frame, each lower coupling mechanism being mounted to rotate with the plurality of coupled lower drive shaft sections;
 - a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;

a plurality of knife holder assemblies supported by the upper and lower frames in pairs for movement along the drive shaft assemblies such that a first knife holder assembly is supported for movement along the upper drive shaft assembly and a second knife holder assembly is supported for movement along the lower drive shaft assembly; and

a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

wherein the upper frame is pivotally coupled to the lower frame through a pivot shaft to adjust relative vertical positioning of the knives of the first and second knife holder assemblies for slitting metal sheets of differing thicknesses.

16. (Original) The machine of claim 15 further comprising:

a frame adjustment mechanism for adjusting relative vertical positioning of the knives of the first and second knife holder assemblies in a direction generally perpendicular to the axes of the drive shaft assemblies.

17. (Original) The machine of claim 16 wherein the frame adjustment mechanism further comprises:

a pair of jack screws each mounted between the upper and lower frames.

18. (Original) The machine of claim 17 further comprising:

an actuator coupled to each of the jack screws for simultaneous adjustment of the
jack screws.

19. (Original) The machine of claim 15 wherein movement of the upper frame
relative to the lower frame maintains the frames generally parallel relative to each other.

20. (Previously presented) The machine of claim 19 wherein the pivot shaft is
offset from each of the upper and lower drive shaft assemblies.

21. (Previously presented) A machine for slitting a metal sheet comprising:

an upper frame;

a lower frame pivotally coupled to the upper frame through a pivot shaft;

an upper drive shaft assembly mounted for rotation in the upper frame, said upper
drive shaft assembly comprising a plurality of upper drive shaft sections each being coupled
through an upper coupling mechanism to an adjacent upper drive shaft section for rotation in the
frame, each upper coupling mechanism being mounted to rotate with the plurality of coupled
upper drive shaft sections;

a lower drive shaft assembly mounted for rotation in the lower frame, said lower drive shaft assembly comprising a plurality of lower drive shaft sections each being coupled through a lower coupling mechanism to an adjacent lower drive shaft section for rotation in the frame, each lower coupling mechanism being mounted to rotate with the plurality of coupled lower drive shaft sections;

a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;

a plurality of knife holder assemblies supported by the upper and lower frames in pairs on the drive shaft assemblies such that a first knife holder assembly is supported for movement along the upper drive shaft assembly and a second knife holder assembly is supported for movement along the lower drive shaft assembly; and

a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

a pair of jack screws each mounted between the upper and lower frames for adjusting relative vertical positioning of the knives of the first and second knife holder assemblies in a direction generally perpendicular to the axes of the drive shaft assemblies for slitting metal sheets of differing thicknesses;

wherein movement of the upper frame relative to the lower frame maintains the frames generally parallel relative to each other; and

an actuator coupled to each of the jack screws for simultaneous adjustment of the jack screws.

22. (Previously presented) A machine for slitting a metal sheet comprising:

an upper frame;

a lower frame coupled to the upper frame;

an upper drive shaft assembly mounted for rotation in the upper frame, said upper drive shaft assembly comprising a plurality of upper drive shaft sections each being coupled through an upper coupling mechanism to an adjacent upper drive shaft section for rotation in the frame, each upper coupling mechanism being mounted to rotate with the plurality of coupled upper drive shaft sections;

a lower drive shaft assembly mounted for rotation in the lower frame, said lower drive shaft assembly comprising a plurality of lower drive shaft sections each being coupled through a lower coupling mechanism to an adjacent lower drive shaft section for rotation in the frame, each lower coupling mechanism being mounted to rotate with the plurality of coupled lower drive shaft sections;

a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;

a plurality of knife holder assemblies supported by the upper and lower frames in pairs on the drive shaft assemblies such that a first knife holder assembly is supported for movement along the upper drive shaft assembly and a second knife holder assembly is supported for movement along the lower drive shaft assembly;

a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

a knife holder position adjustment system operably coupled to each of the knife holder assemblies for movement of the knife holder assembly along the respective drive shaft assembly; and

a programmable controller operably coupled to the knife holder position adjustment system to position the knife holder assemblies along the respective drive shaft assemblies;

wherein the upper frame is pivotally coupled to the lower frame through a pivot shaft to adjust relative vertical positioning of the knives of the first and second knife holder assemblies for slitting metal sheets of differing thicknesses.

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23. (Previously presented) A machine for slitting a metal sheet comprising:
- an upper frame;
 - a lower frame coupled to the upper frame;
 - an upper drive shaft assembly mounted for rotation in the upper frame;
 - a lower drive shaft assembly mounted for rotation in the lower frame;
 - each of the drive shaft assemblies comprising a plurality of drive shaft sections each being releasably coupled to an adjacent drive shaft section for rotation in the associated frame;
 - a coupling mounted to releasably couple the adjacent drive shaft sections together and rotate with the drive shaft sections;
 - a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;
 - a plurality of knife holder assemblies supported by the upper and lower frames in pairs supported for movement along the drive shaft assemblies such that a first knife holder assembly is supported for movement along the upper drive shaft assembly and a second knife holder assembly is supported for movement along the lower drive shaft assembly;
 - a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;
 - wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder

assemblies;

wherein the adjacent drive shaft sections of each drive shaft assembly are adapted to be selectively uncoupled from one another for servicing the machine;

wherein the upper frame is movable relative to the lower frame to adjust relative vertical positioning of the knives of the first and second knife holder assemblies for slitting metal sheets of differing thicknesses.

24. (Previously presented) A machine for slitting a metal sheet comprising:

an upper frame;

a lower frame coupled to the upper frame;

an upper drive shaft assembly mounted for rotation in the upper frame;

a lower drive shaft assembly mounted for rotation in the lower frame;

each of the drive shaft assemblies comprising a plurality of drive shaft sections each being releasably coupled to an adjacent drive shaft section for rotation in the respective frame;

wherein the adjacent drive shaft sections of each drive shaft assembly are adapted to be selectively uncoupled from one another for servicing the machine;

a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;

a plurality of knife holder assemblies supported by the upper and lower frames in

pairs for movement along the drive shaft assemblies such that a first knife holder assembly is supported for movement along the upper drive shaft assembly and a second knife holder assembly is supported for movement along the lower drive shaft assembly;

a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

wherein the upper frame is pivotally coupled to the lower frame through a pivot shaft to adjust relative vertical positioning of the knives of the first and second drive shaft assemblies for slitting metal sheets of differing thicknesses;

a knife holder position adjustment system operably coupled to each of the knife holder assemblies for movement of the knife holder assembly along the respective drive shaft assembly; and

a programmable controller operably coupled to the knife holder position adjustment system to position the knife holder assemblies along the respective drive shaft assemblies.

25. (Previously presented) A machine for slitting a metal sheet comprising:
a frame;

an upper drive shaft assembly mounted for rotation in the frame, said upper drive shaft assembly comprising a plurality of upper drive shaft sections each being coupled through an upper coupling mechanism to an adjacent upper drive shaft section for rotation in the frame, each upper coupling mechanism being mounted to rotate with the plurality of coupled upper drive shaft sections;

a lower drive shaft assembly mounted for rotation in the frame, said lower drive shaft assembly comprising a plurality of lower drive shaft sections each being coupled through a lower coupling mechanism to an adjacent lower drive shaft section for rotation in the frame, each lower coupling mechanism being mounted to rotate with the plurality of coupled lower drive shaft sections;

a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;

inner and outer pairs of upper rail supports;

inner and outer pairs of lower rail supports;

a plurality of knife holder assemblies supported by the frame in pairs for movement along the drive shaft assemblies such that a first knife holder assembly is supported by one pair of the inner and outer pairs of upper rail supports for movement along the upper drive shaft assembly and being nestable with an adjacent first knife holder assembly and a second knife holder assembly is supported by one pair of the inner and outer pairs of lower rail supports for movement along the lower drive shaft assembly and being nestable with an adjacent second knife

holder assembly;

a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

knife holder position adjustment means for moving each of the knife holder assemblies along the respective drive shaft assembly; and

controller means for controlling the knife holder position adjustment means.

26. (Previously presented) A machine for slitting a metal sheet comprising:

an upper frame;

a lower frame pivotally coupled to the upper frame through a pivot shaft;

an upper drive shaft assembly mounted for rotation in the upper frame, said upper drive shaft assembly comprising a plurality of upper drive shaft sections each being coupled through an upper coupling mechanism to an adjacent upper drive shaft section for rotation in the frame, each upper coupling mechanism being mounted to rotate with the plurality of coupled upper drive shaft sections;

a lower drive shaft assembly mounted for rotation in the lower frame, said lower drive shaft assembly comprising a plurality of lower drive shaft sections each being coupled through a

lower coupling mechanism to an adjacent lower drive shaft section for rotation in the frame, each lower coupling mechanism being mounted to rotate with the plurality of coupled lower drive shaft sections;

a drive motor operably coupled to the upper and the lower drive shaft assemblies for rotation of the drive shaft assemblies;

a plurality of knife holder assemblies supported by the upper and lower frames in pairs supported for movement along the drive shaft assemblies such that a first knife holder assembly is supported for movement along the upper drive shaft assembly and a second knife holder assembly is supported for movement along the lower drive shaft assembly; and

a plurality of rotary knives each being mounted in one of the knife holder assemblies and driven by one of the upper and lower drive shaft assemblies;

wherein the knives of the first and second knife holder assemblies cooperate to slit the metal sheet passing through a nip between the knives of the respective knife holder assemblies;

frame moving means for moving the upper frame relative to the lower frame to adjust a relative vertical positioning of the knives of the first and second knife holder assemblies for slitting metal sheets of differing thicknesses.

27. (Withdrawn) A method of slitting a metal sheet comprising the steps of:
inputting a first set of parameters of the metal sheet into an electronic input

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device;

inputting a second set of parameters of mullets to be slit from the metal sheet into the electronic input device;

processing the first and second set of parameters in a computer to generate a configuration for a plurality of knife blades; and

automatically positioning the plurality of knife blades on a slitting machine according to the configuration.

28. (Withdrawn) A method of servicing a knife holder assembly mounted on a shaft of a slitting machine, the method comprising the steps of:

moving the knife holder assembly toward a juncture between first and second sections of the shaft, the sections of the shaft being generally co-linear with one another during operation of the slitting machine;

moving the first section of the shaft relative to the second section to thereby provide increased access to the knife holder assembly positioned proximate the juncture between the sections;

servicing the knife holder assembly; and

moving the first section relative to the second section into an operational arrangement for the slitting machine.

29. (Withdrawn) A method of operating a slitting machine to slit metal sheets of differing thicknesses, the method comprising the steps of:

passing a first metal sheet of a first thickness into a nip between a plurality of rotating knife blades driven by generally parallel upper and lower shafts mounted for rotation in upper and lower portions of a machine frame, respectively;

slitting the first metal sheet with the knife blades into a first set of mulds;

moving the upper shaft relative to the lower shaft and thereby changing relative vertical positioning of the knives driven by the upper and lower shafts;

wherein the upper shaft remains generally parallel to the lower shaft during the moving of the upper shaft relative to the lower shaft;

passing a second metal sheet of a second thickness into the nip between the knife blades, the second thickness being different than the first thickness; and

slitting the second metal sheet with the knife blades into a second set of mulds.